Hiroyoshi OHASHI* & Miyoko IIJIMA**: **The chromosome of the section Podocarpium (Leguminosae-*Desmodium*)**

大橋広好*・飯島美代子**: ヌスビトハギ節の染色体 (マメ科・ヌスビトハギ属)***

The chromosome numbers of the Asiatic species of the genus *Desmodium* and its allied genera are summarized by Ohashi (1973). In *Desmodium* all of the Asiatic species hitherto been examined have 11 chromosomes in the pollen mother cells or 22 in the somatic cells, but two species from Africa and America are known to have 2n=20. Recently, however, 2n=20 and 2n=24 were reported by Kondo *et al.* (1977) from the materials collected in Japan. According to them, 2n=20 was found in *D. heterocarpon* (L.) DC. subsp. *heterocarpon* var. *heterocarpon* and 2n=24 in *D. podocarpum* DC. subsp. *oxyphyllum* (DC.) Ohashi. The 24 chromosomes in the somatic cells were new to the genus.

The section Podocarpium of the subgenus Podocarpium in *Desmodium*, which was delimited by Ohashi (l.c.), contains 3 species, i.e., *D. oldhami* Oliver, *D. podocarpum* DC. and *D. laxum* DC. These species are considered to form one of the most specialized species-group in the genus, because they are herbs having lax-flowered racemes, flowers without bracteoles, monadelphous stamens, deeply constricted, 2-3-jointed fruits which are uncinate-hairy, large cotyledons which are hypogeal when germinate, and seeds without a rim-aril (Ohashi, l.c.). The former two species extend their distribution into cool-temperate regions showing remarkable features for adaptation in gross-morphology and ecology to such climatic regions. Therefore, the chromosomes of these specialized species seem to be an interesting problem for examination. During last several years we have studied variation of these species of the section Podocarpium in various characters including chromosomes. These species are all growing rather commonly in Japan. In the present paper we report the results of our studies on chromosomes of these species.

Materials and methods Materials examined in the present study were col-

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lected from various localities by Y. Tateishi, J. Murata, Y. Quadota and ourselves as listed in Table 1. These plants have been cultivated in The Botanical Gardens Koishikawa, Faculty of Science, University of Tokyo. Voucher specimens are kept in The Herbarium, Faculty of Science, University of Tokyo (TI) and duplicate ones are in The Herbaia of National Science Museum (TNS), Department of Botany in Kyoto University (KYO) and Biological Institute in Tohoku University (TUS). The somatic chromosomes were examined in root-tip cells of these cultivated materials. Preparations for observation were carried out in the following procedure; the root-tips were pretreated with 0.002 M 8-hydroxyquinoline aqueous solution at about 18°C for 2 hours and then fixed in the Carnoy's solution. These root-tips were macerated in 1N HCl for about 10 seconds at about 60°C and stained by Schiff's reagent. They were squashed with the usual techniques.

Karyotype formulae are expressed as the same method used by Kondo *et al.* (l. c.) for the convenience of comparison our results with theirs. The symbols used are as follows; m=metacentric chromosome, sm=submetacentric chromosome and st=subtelocentric chromosome.

Observations The chromosomes of *Desmodium oldhami* have hitherto been unknown, but it becomes clear that they are 2n=22 and the karyotype is 16m +4sm+2st. Moreover, it is remarkable that all the chromosomes of *D. oldhami* are distinctly larger than those of *D. laxum* and *D. podocarpum*. Comparing the size of chromosomes by the length of all the chromosomes in one cell, the total length of these 22 chromosomes of these species are as follows: 95.6 μ in *D. oldhami* (materials from Kozori), 62.9 μ in *D. laxum* (in subsp. *laterale*) and 48.8-59.6 μ in *D. podocarpum*. *D. laxum* is divided into 3 subspecies, i.e., subsp. *laxum*, subsp. *leptopus* (A. Gray ex Benth.) Ohashi and subsp. *laterale* (Schindl.) Ohashi. All of these subspecies have 22 chromosomes in the somatic cells. These are the first reports for this species. The karyotype of subsp. *laterale* is 22=16m+6sm which resembles that of *D. podocarpum*. The total length of chromosomes of *D. laxum* is not shorter than that of *D. podocarpum* as mentioned above. The somatic chromosome numbers of *D. podocarpum* subsp. *podocarpum* have not been reported and only n=11 is known from an Indian material (cf. Ohashi 1973). From a Japanese material of this subspecies it is known that the number of chromosomes is 22 in the somatic cells and the karyotype is 16m+6sm. This karyotype is reported by Kondo *et al.* (l.c.) as

Table 1. Materials examined and chromosome numbers of *Desmodium* sect. Podocarpium.

Taxa	Original localities	Chromosome numbers
Desmodium oldhami	Tochigi Pref.: Kanuma-shi, Itaga, alt. 200 m, 8 Oct. 1978 (Ohashi *et al.* 1545)	2n=22
	Saitama Pref.: Hanno-shi, Mt. Izugatake, 26 Oct. 1978 (Iijima)	2n=22
	Yamanashi Pref.: Minamikoma-gun, Nanbu-machi, Kozori, alt. 400-700 m, 22 Oct. 1978 (Tateishi *et al.* 4557)	2n=22
D. laxum		
subsp. *laxum*	Shizuoka Pref.: Kakegawa-shi, Ketsuenzi—Itasawa, alt. 50-100 m, 3 Apr. 1978 (Ohashi & Tateishi)	2n=22
subsp. *leptopus*	Okinawa Pref.: Isl. Iriomote, 13 Nov. 1976 (Ohashi & Tateishi)	2n=22
subsp. *laterale*	Miyazaki Pref.: Nichinan-shi, Udo, 30 Dec. 1978 (Murata 7010)	2n=22
D. podocarpum		
subsp. *podocarpum*	Nagasaki Pref.: Isl. Tsushima, Kamiagata-machi, Saozaki, 14 Oct. 1976 (Ohashi & Tateishi 779)	2n=22
subsp. *fallax*	Gunma Pref.: Tano-gun, Mt. Mikabo, 3 Sept. 1975 (Murata & Tateishi)	2n=22
subsp. *oxyphyllum*		
var. *oxyphyllum*	Kagoshima Pref.: Aira-gun, Yoshi-matsu-machi, Oct. 1975 (Tateishi 3593)	2n=22
	Miyazaki Pref.: Nishiusuki-gun, Takachiho-machi, alt. 150-250 m, 29 Sept. 1975 (Tateishi 3328)	2n=22
	Kanagawa Pref.: Kawasaki-shi (Quadota)	2n=22
var. *mandshuricum*	Nagasaki Pref.: Isl. Tsushima, Shimoagata-gun, Himi, alt. 50 m, 23 Oct. 1973 (Ohashi *et al.* 66)	2n=22

the most frequent one in subsp. *oxyphyllum*. Other two subspecies, subsp. *oxyphyllum* and subsp. *fallax* (Schindl.) Ohashi, have also 22 chromosomes in the somatic cells, and their karyotype is 14m+8sm, which is quite similar to that of subsp. *podocarpum*. In *D. podocarpum* the total length of chromosomes varies from 48.8 μ to 59.6 μ as mentioned above. As far as the materials examined are concerned the chromosome- length of the subspecies is as follows: 48.8 μ in subsp. *oxyphyllum* (materials from Yoshimatsu-machi), 57.6 μ in subsp. *fallax* and 59.6 μ in subsp. *podocarpum*.

Discussion Throughout the chromosomes of the taxa in the section Podocarpium, the somatic cells we examined have uniformly 22 chromosomes and the karyotypes are all quite similar except for the chromosome size. These facts strongly suggest that these taxa are closely related to each other. The difference in the size of chromosomes seems to be significantly related to the difference of gross-morphology and distribution of the taxa in the section. The relationships between *D. oldhami* and the others of the section Podocarpium were stated by Isely (1951) and Ohashi (l.c. p. 134) that *D. oldhami* is less advanced than the other species. Accordingly, if this supposition is acceptable, the large-sized chromosomes of *D. oldhami* may be considered as less specialized than the small-sized ones of the other species of this section. This supposition is, also, supported in *D. podocarpum*. This species is considered as most advanced in the subgenus Podocarpium (Ohashi, l. c. p. 144), and the total chromosome-length of this species is minimum among the species of the most evolved section in the subgenus. Moreover, among the three subspecies of *D. podocarpum* the similar relationships are seen between degree of specialization and the total chromosome-length. These subspecies are divided into two groups by the chromosome-length, i.e. less than 50 μ in subsp. *oxyphyllum* against near 60 μ in the remaining two subspecies. In gross-morphology and distribution subsp. *oxyphyllum* may be regarded as more specialized than subsp. *podocarpum* and subsp. *fallax*.

Among the 22 chromosomes of the section Podocarpium two middle-sized submetacentric ones are easily separable into two parts near the kinetochore. Accordingly, though we did not find a plant with 24 chromosomes in the somatic cells, such one may possibly occur among natural populations as reported by Kondo *et al.* (l.c.).

References

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ヌスビトハギ節 sect. Podocarpium に属するヌスビトハギ *Desmodium podocarpum* subsp. *oxyphyllum*, マルバヌスビトハギ *D. podocarpum* subsp. *podocarpum*, ケヤブハギ *D. podocarpum* subsp. *fallax*, オオバヌスビトハギ *D. laxum* subsp. *laxum*, トキワヤブハギ *D. laxum* subsp. *leptopus*, リュウキュウヌスビトハギ *D. laxum* subsp. *laterale* およびフジカンゾウ *D. oldhami* は，主として外部形態，生態，分布に基づいて，ヌスビトハギ属の中で最も進化した群の一つと考えられている (Ohashi, 1973)。細胞学的にもこれを裏付ける事実を発見したいと考え，数年来これらの種類の染色体数と核型について調査を続けている。

アジアに産するヌスビトハギ属植物の染色体数は，今日まで調べられた種類でみると，大多数が 2n＝22 あるいは n＝11 である (Ohashi, 1973)。しかし，最近になって2例だけ例外が報告された。シバハギの 2n＝20 とヌスビトハギの 2n＝24 である。両例とも近藤他 (1977) によるもので，広島市で採集した個体を研究材料に用いている。2n＝20 はこれまでアジアからは未知であったが，アフリカとアメリカの材料からは報告されていた。2n＝24 はヌスビトハギ属として新しい数である。シバハギはハイマキエハギ亜属 subgen. Sagotia の種類であるため，今回の報告では対象としなかったが，それ以前には n＝11, 2n＝22 と報告されていた。しかし，アフリカからの 2n＝20 は同じ亜属の別種から発見されたものであり，本種が形態的，生態的変異に富むことをみれば，染色体での変異も十分おこりうることであろう。一方，ヌスビトハギの 2n＝24 は，前述のように，属での新しい染色体数であり，ヌスビトハギ節の種分化と関連があるかもしれない点で興味深いものであった。

われわれの研究はまだ調べた個体数も少なく，不十分であるが，研究材料とその染色体数は表1にまとめてある。本報告では次の点について明らかにした。

1. フジカンゾウ，オオバヌスビトハギ，トキワヤブハギおよびリュウキュウヌスビトハギの染色体と核型については初めての報告であり，染色体数は 2n＝22, 核型はフジカンゾウ 16m＋4sm＋2st, リュウキュウヌスビトハギ 16m＋6sm であった。

2. マルバヌスビトハギは従来インド産の材料で n＝11 が知られていたが，今回体細

胞で 2n=22 であることを報告した。核型は 16m+6sm である，なお，ヌスビトハギおよびケヤブハギについては既に 2n=22 およびヌスビトハギでのみ 2n=24 が知られていたが，今回のわれわれの結果は 2n=22 であった。核型は両亜種ともに 14m+6sm である。

3. ヌスビトハギ節に属する種類の核型はいずれもよく似ており，近縁であることが示されているが，染色体の大きさには明らかな相違がみられる。22本の合計の長さで比較してみると，短かいものからヌスビトハギ，マルバヌスビトハギおよびケヤブハギ，リュウキュウヌスビトハギ，フジカンゾウの順で長くなっていた。外部形態，花粉および地理的分布にもとづいた結論 (Ohashi 1973) と比較すると，長い染色体（すなわち大形のもの）をもつ種類ほど原始的であると考えられる。

4. 調べたすべての細胞では，22本の染色体のうちの2本（いずれも sm で，大きいものから順に11から14番目のもの）は動原体附近で切れやすいことが認められた。

終わりに，本研究に用いた材料の収集に協力していただいた東京大学総合研究資料館植物部門立石庸一氏，同理学部附属植物園邑田仁氏および国立科学博物館門田裕一氏にお礼を申し上げる。

□鈴木 進：**原色すみれ** 209 pp.（内 pls. 160）. 1980. 家の光協会。¥1,600. スミレの図譜も何部か有るが，これは原色写真を集めたもの。種，変種，花色や班入りの変異を網羅し，その後に，人工交配や天然の雑種などで発見したものを載せているので，仲々見応えがある。終りに，分類，分布，性質，観賞のための栽培法，用土，鉢，植え込み方法，肥料，病害虫などを記す。寄植えにハイユキソウがよいとか，ナメクジは使用済の注射針でさすとよいとか中々穿っている。本書をみて *Viola* の節がほんとうに普及したとしみじみ思われる。末尾にそえた自然状態における交雑の組合せ，人工交配による組合せの表は大変参考になる。（前川文夫）

□山本 正・高畑 滋・森田弘彦：**北海道山菜誌** 256+8 pp. 北海道大学図書刊行会. ¥1,200. 異色の山菜誌である．北海道農業試験場に勤務される三人の合作で，山本氏の退官記念出版物でもある。三人の異なる特色が，ことに第一部の3個の文章によく出ている。高畑氏の山菜の章は山菜の意味を理解し，森田氏の植物学からみた山菜はカタクリを例にとって述べ，山本氏の山菜文化史では，トコロを土台に，現代の状態から徳川，万葉と逆に追い上げて行って，山菜を仲介としての人間とのふれ方に当って行く。第三が特に面白い。

第二部は三人が原稿を廻り持ちして書かれたもので，45種類しかあがっていないが，さすが，北に偏した北海道としての主材の良さが目にうつる。記事も手慣れた感じで肩がこらずによめる。近来にない一冊である。（前川文夫）